CLAIMS

We claim:

1. A recirculating hydrogen-oxygen alkaline fuel-cell, comprising:

an alkaline matrix electrolyte interposed between a porous anode and porous cathode;

an oxygen flow network in fluid connection with said porous cathode, said oxygen flow network having an input portion for supplying oxygen and an output portion for removing said oxygen after electrochemical reaction, and

a hydrogen flow network in fluid connection with said porous anode, said hydrogen network having an input portion for supplying hydrogen and an output portion for removing hydrogen after electrochemical reaction, wherein at least one of said oxygen flow network and said hydrogen flow network includes a feedback conduit to form a recirculation loop, said recirculation loop feeding back a portion of said hydrogen or said oxygen after electrochemical reaction to said input portion.

2. The fuel cell of claim 1, wherein said oxygen flow network includes said recirculation loop, said recirculation loop providing a humidified flow to said input portion of said oxygen flow network.

3. The fuel cell of claim 2, wherein a volume of said humidified flow is adjustable, said humidified flow volume increasing with a load on said fuel cell.

4. The fuel cell of claim 2, wherein said fuel cell includes a jet pump in said oxygen recirculation loop, said jet pump inducing recirculation in said oxygen recirculation loop.

5. The fuel cell of claim 1, wherein both said oxygen flow network and said hydrogen flow network includes a recirculation loop.

6. The fuel cell of claim 1, further comprising a flow modulator fluidicly connected with at least one of an input portion said hydrogen flow network and an input portion of said oxygen flow network, wherein said modulator provides a time varying mass flow of said hydrogen or said oxygen.

7. The fuel cell of claim 6, wherein said modulator is operative across all fuel cell load conditions.

8. The fuel cell of claim 6, wherein said hydrogen flow network includes a first modulator and said oxidant flow network includes a second modulator, said first and second modulator being communicably connected.

9. The fuel cell of claim 6, wherein said flow modulator provides discrete pulses of hydrogen or oxygen flow.

10. The fuel cell of claim 6, wherein said modulator comprises a pressure sensor - controlled two-positional pressure regulator having only two positions, a first position being a fully open position and the other position being fully closed.

11. A method of operating an alkaline hydrogen-oxygen fuel cell (AFC), comprising the steps of:

providing a hydrogen flow to an anode of said fuel cell, and

providing an oxygen flow to a cathode of said fuel cell, wherein at least one of said hydrogen flow and said oxygen flow comprises a recirculated flow portion.

12. The method of claim 11, wherein said oxygen flow comprises a recirculated flow portion, wherein said recirculated flow portion is humidified.

13. The method of claim 11, wherein at least one of said hydrogen flow and said oxygen flow is a time varying mass flow, said mass flow varying with a load on said fuel cell.

14. The method of claim 13, wherein said time varying mass flow is operative across all loads on said fuel cell.

15. The method of claim 13, wherein said time varying mass flow comprises discrete pulses.

16. The method of claim 11, wherein both said hydrogen flow and said oxygen flow is a time varying mass flow, further comprising the step of time synchronizing said mass flow of said hydrogen flow with said mass flow of said oxygen flow.